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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/749,529

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Yuegang Zhang

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EXAMINER

SINES, BRIAN J

ART UNIT

PAPER NUMBER

1797

MAIL DATE

DELIVERY MODE

11/15/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/749,529

Applicant(s)

ZHANG ET AL.

Examiner

Brian J. Sines

Art Unit

1797

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 August 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1 and 4-31 is/are pending in the application.
- 4a) Of the above claim(s) 25-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 4-24 and 31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

This application contains claims 25 – 30 are drawn to an invention nonelected with traverse in the reply filed on 11/30/2005. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Response to Arguments

Applicant's arguments with respect to the amended claims have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

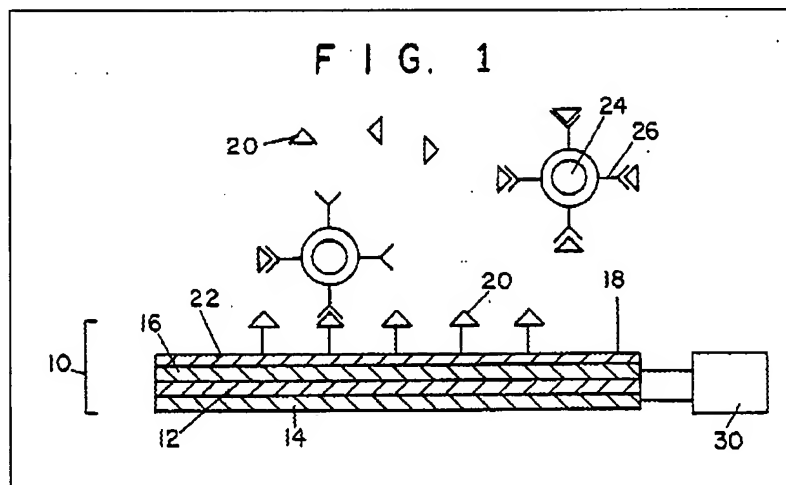
(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

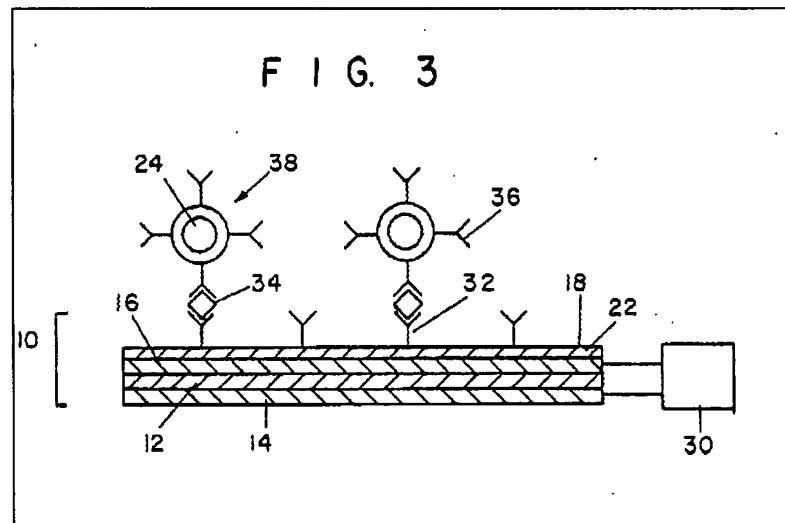
The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. Claims 1, 4 – 13, 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ward et al. (U.S. Pat. No. 5,501,986 A) (“Ward”) in view of Oyama et al. (U.S Pat. No. 5,552,274) (“Oyama”) and Yamada et al. (U.S Pat. No. 6,842,088 B2) (“Yamada”).

Regarding claims 1, 10 – 13, 22 and 23, Ward teaches a detection system 10 comprising: a test resonator (quartz crystal wafer 12) comprising a layer of piezoelectric material sandwiched between a pair of electrodes (14 and 16), wherein at least one surface of one of the electrodes 16 comprises a functionalized surface (e.g., coating layer 22 and surface 18) that is functionalized with a specific binding reagent 32 to bind with target molecules 34 in a liquid sample and wherein the system is configured to prevent exposure of one of the electrodes 14 to the liquid sample; and a control and detection circuitry comprising an oscillator circuit 30 (see, e.g., col. 3, line 25 – col. 6, line 20; col. 5, lines 25 – 62; figures 1 and 3). As shown in figure 1, note that only one side of the disclosed device, namely the functionalized electrode 16, is exposed to the liquid sample containing the target molecules. The other electrode 14 is not intended or required to be exposed the liquid sample.





Ward does not specifically teach the incorporation of the control circuit as claimed with the disclosed sensing device.

The applicant is advised that the Supreme Court recently clarified that a claim can be proved obvious merely by showing that the combination of known elements was obvious to try. In this regard, the Supreme Court explained that, “[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has a good reason to pursue the known options within his or her technical grasp.” An obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of the case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. (“The combination of familiar elements is likely to be obvious when it does no more than yield predictable results.”). See *KSR Int’l v. Teleflex Inc.*, 127 Sup. Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007). In this regard, Oyama teaches a similar resonator-based sensing system comprising a control circuit comprising a signal generating circuit (oscillation circuit 20) and a processing

circuit 70 to measure the impedance of a resonator to facilitate target molecule detection (see, e.g., col. 5, line 60 – col. 8, line 60; figures 2, 4 and 6). As shown by Oyama, the control circuit is known and would have yielded the predictable result of facilitating effective resonator operation. Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the claimed control circuit with the disclosed sensing system of Ward in order to facilitate effective sensing device operation.

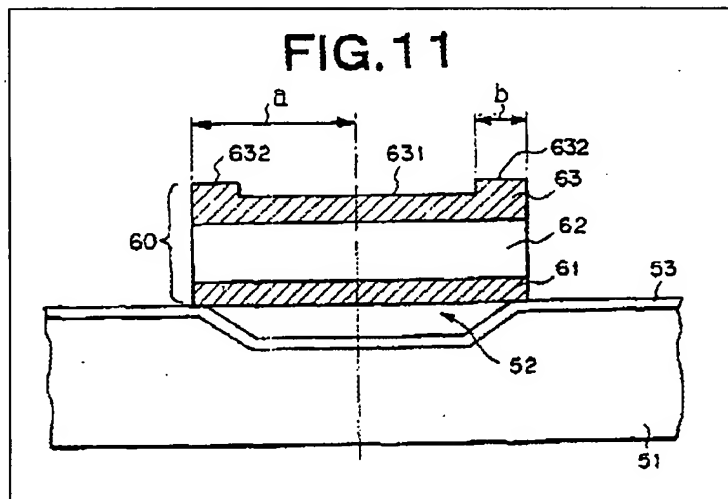
With respect to claims 5 – 9, the control circuit disclosed by Oyama is capable of being operated using these types of excitation signals (see, e.g., col. 5, line 60 – col. 8, line 60; figures 2, 4 and 6).

Neither Ward nor Oyama specifically teach the incorporation of a silicon-containing substrate for supporting the resonator.

Yamada teaches a resonator device incorporating a support substrate comprising a typical silicon wafer 51 (see, e.g., Abstract; col. 11, lines 1 – 66; figures 1 – 6). Yamada teaches that the disclosed device structure is suitable for incorporation with piezoelectric resonator-based sensing devices (see col. 1, lines 10 – 22) (see MPEP § 2144.07). Yamada teaches the advantages of the disclosed device structure (see col. 1, line 25 – col. 6, line 13). “The combination of familiar elements is likely to be obvious when it does no more than yield predictable results.” See *KSR Int’l v. Teleflex Inc.*, 127 Sup. Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007). Consequently, a person of ordinary skill in this art would accordingly have recognized the suitability of incorporating the support substrate of Yamada with the disclosed sensing system. Furthermore, a person of ordinary skill in the art would accordingly have had a reasonable expectation for

success of incorporating the disclosed device structure with a related resonator-based sensing system. The prior art can be modified or combined to reject claims as *prima facie* obvious as long as there is a reasonable expectation of success (see MPEP § 2143.02). Therefore, a person of ordinary skill in this art would accordingly have recognized the suitability of incorporating the support substrate of Yamada with the disclosed sensing system to facilitate the optimal operation of the disclosed resonator-based sensing system.

As disclosed by Yamada in figure 11, the structure 60 comprising resonator 62 is attached to the supporting substrate 51 at its edges and wherein the top electrode 63 has an exposed surface.



Regarding claim 4, Yamada teaches the use of AlN and ZnO as resonator materials that are well known in the art (see col. 5, lines 51 – 58). The selection of a known material, which is based upon its suitability for the intended use, is within the ambit of one of ordinary skill in the art (see MPEP § 2144.07).

2. Claims 14 – 21 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over the aforementioned cited prior art view of Blackburn et al. (U.S. Pat. No. 6,846,654 B1) (“Blackburn”).

Regarding claims 14 – 21 and 24, the above cited prior art does not specifically teach the incorporation of an organic membrane as claimed.

Ward does teach the incorporation of a polymer film layer 22 for immobilization (see, e.g., col. 3, lines 45 – 58; figure 1). Ward further teaches spin-coating application of layer 22 and silanization of metal and glass surfaces of the device for facilitating immobilization of binding biomolecules (see col. 3, lines 46 – 58).

Blackburn teaches the use of an organic membrane as a support material for immobilizing binding biomolecules, i.e., antibodies. Blackburn also teaches the use of lipid bilayer membranes (see, e.g., col. 16, line 37 – col. 17, line 21; col. 18, lines 5 – 29). The selection of a known material, which is based upon its suitability for the intended use, is within the ambit of one of ordinary skill in the art (see MPEP § 2144.07). In addition, the use of silylation, acylation, esterification and alkylation are chemical derivatization methods for facilitating ligand immobilization that are well known in the art (see MPEP § 2144.03). Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the use of an organic membrane as claimed with the disclosed sensing device.

3. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over the aforementioned cited prior art view of Gao et al. (U.S. Pat. No. 6,218,507 B1) ("Gao").

Regarding claim 31, the aforementioned cited prior art does not specifically teach the incorporation of a second piezoelectric resonator having a non-functionalized surface.

Ward does teach the incorporation of a secondary or reference piezoelectric resonator crystal (see col. 6, lines 5 – 20).

The use of a reference sensor comprising an uncoated portion, such as an electrode, with detection devices is well known in the art (see MPEP § 2144.03). For example, Gao teaches a related piezoelectric crystal resonator-based detection device comprising an uncoated or non-functionalized piezoelectric crystal electrode that functions to provide reference or control measurements. The determined measurement frequency is recorded as a base frequency and as a blank control measurement that is used with the coated sensing electrode to provide accurate gas detection measurements (see, e.g., col. 9, lines 3 – 16). Furthermore, "[t]he combination of familiar elements is likely to be obvious when it does no more than yield predictable results." See *KSR Int'l v. Teleflex Inc.*, 127 Sup. Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007).

Consequently, as indicated by Gao, a person of ordinary skill in the art would accordingly have recognized the suitability of incorporating such a secondary or reference electrode that is non-functionalized to provide accurate detection measurements. As shown by Gao, a person of ordinary skill in the art would accordingly have had a reasonable expectation for success of incorporating of a second piezoelectric resonator having a non-functionalized electrode surface as claimed with the disclosed sensing device in order to facilitate accurate detection measurements. The prior art can be modified or combined to reject claims as *prima facie*

obvious as long as there is a reasonable expectation of success (see MPEP § 2143.02).

Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the use of a second piezoelectric resonator having a non-functionalized electrode surface as claimed with the disclosed sensing device in order to facilitate accurate detection measurements.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian J. Sines whose telephone number is (571) 272-1263. The examiner can normally be reached on Monday - Friday (11 AM - 8 PM EST).

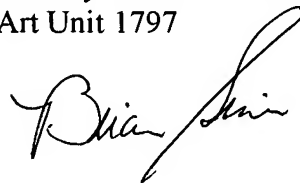
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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill A. Warden can be reached on (571) 272-1267. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Brian J. Sines
Primary Patent Examiner
Art Unit 1797

A handwritten signature in black ink, appearing to read "Brian Sines", written in a cursive style.